III. REMARKS

Claims 1, 4, 5 and 7-14 are currently pending in the present application. Of these pending claims, 1, 5, 9, 11, 12 and 14 have been amended, and claim 13 has been cancelled. No claims have been added. The amendments to the claims are believed to place the current application in condition for allowance.

Claim Rejections – 35 USC § 102

The Examiner has rejected claims 11-13 under 35 USC § 102(b) as being anticipated by Sonderegger, et al. (U.S. Patent No. 3,151,258). The Examiner states:

> Regarding claim 11, Sonderegger et al. discloses a device for measuring the forces between components of an assembly comprising a check device having means for signal value pick-up 33 from an annular measuring element 15 separate and distinct from force applying elements 13, 14 but acted on by the force applying elements (See Col. 3, lines 5-13, 31-38 and 64-70) and whose electrical resistance is continuously variable as a function of the operative axial force (See Col. 5, lines 43-56).

Claim 11 has been amended to require that the annular measuring element comprises a hollow circular cylinder wherein the hollow cylinder has on the upper or lower side at least one piezoresistive layer, or at least one coating of an amorphous diamond-like carbon compound. Support for this amendment can be found at least at page 2, lines 9-14 of the specification as filed.

Sonderegger et al. discloses a measuring element in the form of a washer (No. 83 in Fig. 10). The washer however is described as comprising layers of a piezoelectric material (18, 19, 21, and 22 in Fig. 1), and not as comprising a piezoresistive layer or coating, as in the present invention. It is important to note that piezoresistive materials

are distinct from piezoelectric materials. Both react to forces applied to them. However, a piezoresistive material shows a changing electrical resistance due to applied mechanical stress without causing any electrical charges. Further, the change in resistance continues as long as the force applied to it remains. The piezoelectric material used in Sonderegger, et al., in contrast, has an electrical charge produced by mechanical stress in the piezoelectric material used for the measuring element, and this charge survives for only a short time. Therefore, a measurement is possible only during and immediately after the screw is tightened and not later.

The present invention, however, allows one to check the axial force in the screw joint at any later time as well, as the piezoresistive material keeps its resistance corresponding to the actual mechanical stress after a change in the stress. Since Sonderegger et al. does not show the use of a piezoresistive material, Sonderegger can no longer anticipate claim 11. It is to be noted that the Examiner's citation to Col. 5, lines 43-56, refers to a piezoelectric crystal device, not a piezoresistive device.

With regard to claims 12-14, claim 13 has been cancelled, rendering this ground of rejection moot.

With regard to claims 12 and 14, these have been amended to be dependent claims, further narrowing claim 11, and dealing solely with the piezoresistive nature of the present invention. Support for the amended claims 12 and 14 can be found at least on page 5 of the specification as filed at lines 23-29 and 16-18 respectively.

Claim Rejections – 35 USC § 103

The Examiner has rejected claims 1, 4, 5, and 7-9 as being obvious over Walton (U.S. Patent No. 5,291,789) in view of Sonderegger et al. (U.S. Patent No. 3,151,258). The Examiner states:

> Regarding claim 1, Walton discloses a load indicator comprising a check device for limiting an axial force operating between force-applying elements 11, 13 of the screw joint, the check device including signal value pick-up means 133, 136 from a measuring element whose electrical resistance is variable as a function of the operative axial force.

Regarding Claim 1, it has been amended to require that the electrical resistance "is **continuously** variable as a function of the axial force". Regarding Claim 11, it has always claimed a "**continuously** variable" resistance, and has now been amended to require a "piezoresistive" coating.

The Examiner references Col. 3, lines 13-17, Col. 4, lines 55-64, Col. 5, lines 1-7 and Col. 6, lines 3-35 and 46-51 for the proposition that Walton shows "a measuring element whose electrical resistance is variable as a function of the operative axial force".

In view of the above amendments to clarify the invention, the Examiner's ground of rejection is moot. Applicant does not find in a single one of the citations by the Examiner anything which discloses a measuring element whose electrical resistance is continuously variable as function of the operative axial force. Walton '789 deals entirely with making or breaking of an electrical contact which occurs by stressing the fastening device 12 in Fig. 1. As nut 15 is tightened the shank 17 of the bolt will be stretched and

the electrical contact 24 will come in contact with the surface 20 and complete an electrical circuit between the contacts 28 and 29, and light the bulb 27. The resistance in this case has only two finite values. The resistance is ∞ before the shank 17 of the bolt is stretched, and essentially 0 afterwards. These are two finite values. The other constructions of Walton operate in the same fashion.

Fig. 2 deals with the breaking of the contact between the ball 131 and the contact 124 as the bolt is stretched.

Fig. 3 deals with establishing contact between the contact elements 224 and 231 as the bolt is used to drive the saddle 203 toward the seat 202 to clamp the member 201.

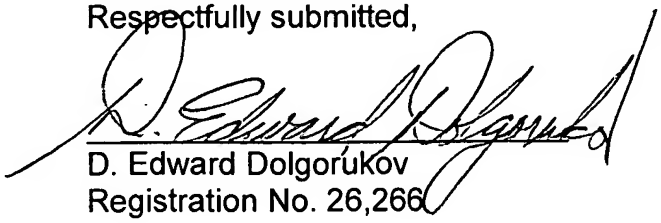
In Fig. 4 the shortening of the member 317 results in the contact between the first contact element 329 and contact element 331. Thus, Walton '789 deals solely with making and breaking electrical contact by the stretching or contracting of various elements and are strictly mechanical in nature. It has nothing to do with electrical resistance continuously varying as a function of the operative force.

Since the washer of Sonderegger, et al. does not make and break an electrical contact, and is brittle; the substitution of the washer of Sonderegger, et al. into the construction of Walton makes no sense. There is no motivation to combine, such a combination would require an impermissible change in construction, and would not produce the structure claimed, nor would the structure which results from such a combination operate in the same manner. Therefore, claims 1, 4, 5, and 7-9 are in no way obvious in view of the combination of Walton and Sonderegger.

The Examiner has rejected claim 10 as being unpatentable over Walton and Sonderegger et al. as applied to claims 1, 4, 5 and 7-9 and further in view of Payne (U.S. Patent No. 4,041,776). The discussion of the inappropriateness of the combination of Sonderegger and Walton above is specifically incorporated herein concerning the rejection of claim 10. The addition of Payne, which does show an optical indicator, still does not produce a construction wherein there is a continuously variable indication of the stress being applied. At best, with this combination made by the Examiner, one would still have only two values, a first finite value when there is no stress, and a second finite value when the desired stress level had been reached. For this reason, claim 10 is not obvious in view of the combination of Sonderegger et al., Walton and Payne. There would be no electrical resistance which is continuously variable as a function of the axial force applied by the force applying element.

None of the cited references, either singly, or in combination, disclose the invention as now claimed. In view of the above amendments, and the remarks explanatory thereof, a favorable reconsideration of the present application, and the passing of this case to issue is courteously solicited.

Respectfully submitted,



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